# CEE3430 Engineering Hydrology

## *Homework 8. SCS Curve Number and Hydrograph*

Date: 3/17/14
Due: 3/26/14

**Objective.** The objective of this homework is to gain experience in computing runoff using the SCS curve number method and Unit Hydrograph and to do practice test questions.

1. Mays 8.7.1
2. Mays 8.7.3
3. Mays 8.7.5
4. Mays 8.8.1
5. Mays 8.8.2

Former test questions

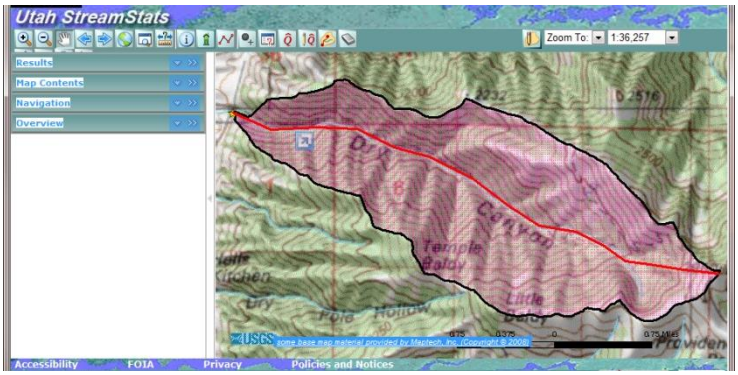
6. Consider a watershed with silty clay loam soil and Green-Ampt parameters given in Mays Table 7.4.1 (page 317). Assume that the soil is initially dry with initial moisture content equal to residual moisture content. Calculate the following using the Green-Ampt approach.

   a) The infiltration capacity (in cm/hr) after 2 cm of infiltrationr
   b) The minimum infiltration capacity

   Now consider a storm where 3 cm of rainfall occurs in 2 hours and calculate the following

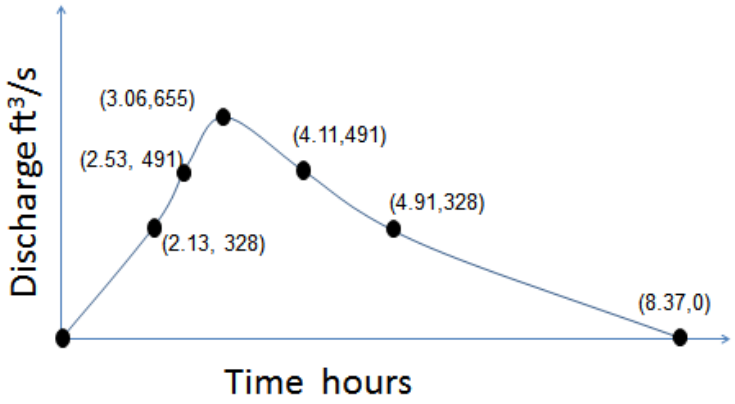
   c) Time to ponding
   d) Depth of infiltration excess runoff generated from this storm

7. In homework 7 you studied Logan Dry Canyon and determined a Snyder unit hydrograph that is given below




Peak $Q_p = 655\ ft^3/s$

0.5 hour Snyder Unit Hydrograph




Assume a hydrologic soil group C and land use with curve numbers as follows

| | | |
|---|---|---|
| Forest-range - Herbaceous (fair condition) | 40 % | CN=80 |
| Juniper-grass (fair condition) | 60% | CN=73 |

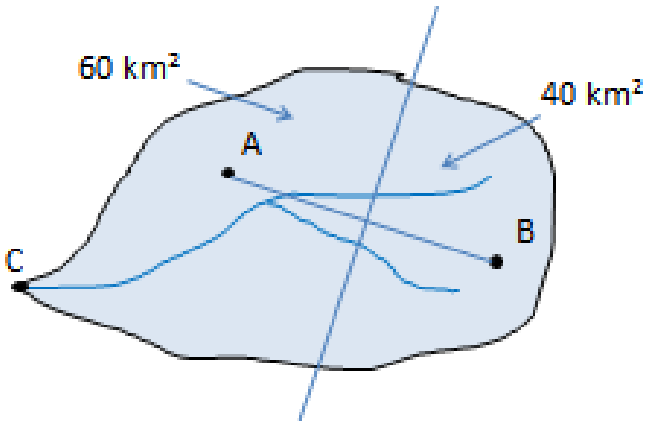
Assume average antecedent moisture conditions. From the NOAA PDFS website (http://hdsc.nws.noaa.gov/hdsc/pfds) the 100 yr 30 min cumulative precipitation is 1.2 in and 60 min cumulative precipitation is 1.49 in. On the basis of these the hyetograph for a design storm is

| Time | 0-30 min | 30-60 min |
|---|---|---|
| Rainfall | 0.29 in | 1.2 in |

Determine the following

a) Excess precipitation in each time interval
b) Peak discharge based on the Snyder Unit Hydrograph above

8. A 100 km$^2$ total watershed has two precipitation gages in locations indicated




The accumulated rainfall in each gage is given below

| Time (min) | A (mm) | B (mm) |
|---|---|---|
| 0 | 0 | 0 |
| 30 | 0 | 0 |
| 60 | 10 | 5 |
| 90 | 25 | 15 |
| 120 | 25 | 20 |
| 150 | 25 | 20 |

An outlet hydrograph measured at location C is

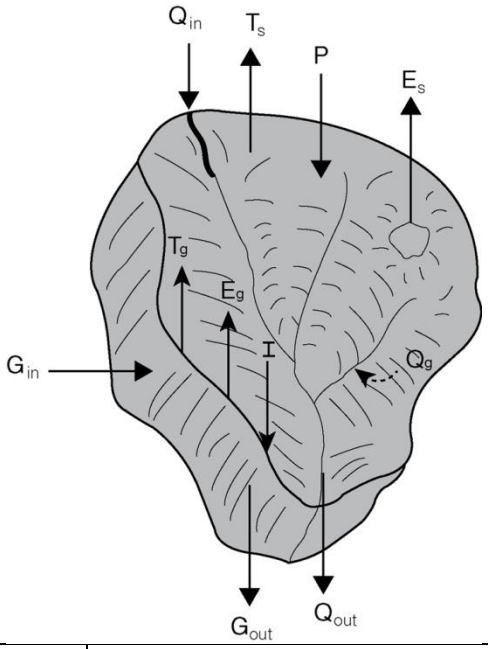
| Time (min) | Discharge at C (m$^3$/s) |
|---|---|
| 0 | 20 |
| 60 | 20 |
| 120 | 140 |
| 180 | 110 |
| 240 | 70 |
| 360 | 20 |

Assume a constant baseflow of 20 m$^3$/s

a) Calculate the area average total precipitation from this storm
b) Calculate the area average precipitation hyetograph for each 30 min increment from this storm
c) Separate the baseflow from direct storm runoff using the assumed constant baseflow and calculate the volume and depth of direct runoff from this storm
d) Assume a constant rate of abstractions and calculate the $\phi$-index for this storm
e) Draw a graph of the 30 min excess precipitation hyetograph for this storm
f) Assume that the $\phi$-index calculated in (d) apples separately to the parts of the watershed represented by gages A and B and calculate the total depth of excess precipitation generated in each part of the watershed
g) Calculate the total depth of excess precipitation over the watershed by combining the contributions from each part

h) Explain why your result in (g) may be different from the total depth of excess precipitation obtained in (e)

i) Consider the watershed water budget depicted by the following figure (From Mays 7.1.11). Fill in the following table for the quantities symbolized for the period of data given above. Please use depth in mm for the values




| Symbol | Name | Value (mm) |
|---|---|---|
| P | | |
| I | | |
| $Q_{out}$ | | |
| $Q_g$ | | |